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ABSTRACT

This document discusses issues and developments related to the effects of new information technology on agriculture, beginning with an overview of the range of information-related issues, the evolving role of information technology, and the "stakeholders" (the groups) involved in advanced information systems for rural America. An examination of information technology and its agricultural applications traces historical developments, delineates the types of information normally used by farmers and ranchers, and discusses the implications of the information revolution in agriculture. A brief chronology reviews selected events in United States history, including recent federal initiatives influencing the utilization of new information systems. Selected information systems demonstrating technological applications are described, including agricultural databases, farm management software, electronic trading systems, videotex systems, and electronic messaging networks. A comprehensive listing of operational agricultural systems in the United States is followed by a map depicting the programs' centers of operations. Activities related to a series of 97th Congress oversight initiatives are summarized, and a 28-item reference list is included. (LMM)

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INFORMATION SERVICES FOR AGRICULTURE: THE ROLE OF TECHNOLOGY

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I. INTRODUCTION

The agricultural scene in the 1980 decade reflects the changing, and yet often strikingly traditional, support provided by our farmers and ranchers who fulfill the wants of this nation. The smaller farms of the legendary "sod-house frontier" have been replaced increasingly by "agri-businesses" of great holdings and financial resources. Nonetheless, the family farm has survived, withstanding--in the words of former Secretary of Agriculture Orville Freeman--"the test of time and competition...[making] this country the envy of the world and American farm production the greatest production miracle in the history of mankind." 1/ Countless innovations have enhanced the production process, and although the number of practicing farmers continued to decline, the agricultural output increased with each passing year. At this time, other factors including greatly inflated equipment and financing costs as well as fluctuations in the marketplace have combined to bring about a serious state of affairs. In his testimony before the House Subcommittee on Department Operations, Research and Foreign Agriculture, self-professed "dirt farmer" Roy Meek declaimed that: 2/

> . . . the agriculture industry is experiencing some of the most difficult times since the Great Depression . . . we have met these problems in the past by increasing our efficiencies of production and increasing our volume of production.

It is the belief of many agricultural leaders, specialists and practitioners that the traditional list of agricultural essential inputs--land, labor, capital--must be expanded in todays' world to

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1/ Bradley, John P. The International Dictionary of Thoughts. Chicago, Ferguson Press, 1969. p. 25.

2/ Remarks of Roy A. Meek, Manager, Eastern Lamb Producers Association, during hearing on Applications of Computer-based Information Systems and Services in Agriculture. U.S. House [illegible] Manuscript, p. 60

include "information." A number of spokesmen and interested parties in both the public and private sectors have gone on record as saying that this new element must be considered the "glue" that melds all of these ingredients in a way that maximizes success. Reliance upon the American farmer has not diminished in the least; indeed, foreign difficulties (Soviet Union, India) in crop production have sharpened the focus on the critical support furnished by our agricultural community. But change is "in the wind" and the consensus exists that an era of reassessment has been entered upon by governmental agencies and private groups with responsibilities related to the agricultural industry.

A Range of Information-Related Issues

In considering the several dimensions of mounting and sustaining an imaginative support effort which could adequately furnish far-flung rural dwellers with timely, comprehensive, accurate, and relevant information of considerable variety, policymakers and program implementers are faced with a spectrum of issues to be addressed:

- The kaleidoscopic roles and responsibilities of established and emerging entities, both in the public and private sectors, who serve as information providers for the agricultural community;
- An ever-pressing requirement to determine to what extent and under which conditions governmentally collected data could be accessed by private vendors;
- The conditions under which individuals or groups at the local level could influence, even to a modest degree, the information offerings--content, frequency, form--made available to them;
- The extent to which formalized responsibility could be assigned to information providers and systems implementers regarding such post-installation activities as training, maintenance, and the modification of files and software;

- o The ramifications of private organizations acquiring government-developed data files and/or software which would then be modified, resulting in "value-added" products and services, with particular attention to ownership of such improved elements.
- o The diversity of hardware and software offerings which has raised vociferous arguments for and against standardization, either through a government mechanism or imposed by the information industry.
- o The desirability of continued, or enhanced, governmental subsidization of research and first-phase enterprises leading to new or improved information services.
- o The need to look ahead at efforts which could be undertaken at present to protect the confidentiality of personal and corporate data being entered into some of the agriculturally-oriented on-line files.

Myriad changes have taken place in the past quarter-century as farmers have moved to stay abreast of the technology which can keep them competitive and productive. Many times they are reportedly at the mercy of the marketplace, and in the past were at a disadvantage in knowing of marketing opportunities, current pricing, or trends in the futures' market. With the introduction of improved information systems which could bring up-to-the-minute information on Board of Trade quotes and analyses of activity patterns across the agricultural industry, agri-businesses and smaller farm units began to feel more in control of their own destinies. These are seen as difficult times for farmers, whose production costs have continued to mount in an unprecendented fashion while the vagaries of the marketplace often have prevented them from obtaining sufficient remuneration for their labors.

One of the key underpinnings of agriculture today is the series of information networks which serve farmers and ranchers and those with whom they regularly interact--the extension services, local governments, banks, and farmers' organizations. The proliferation of computer-based

information systems available to the farmer is bound to impact not only the business operations but many of the personal living patterns as well. Relationships with Federal, State, and country government agricultural specialists may be affected, and the traditional roles of these organizations altered. Consider these questions which must be addressed in the years to come: 3/

- Will new information systems be used to increase the capacity of the county extension service to serve farm and nonfarm clients, or will they replace the traditional extension delivery system for certain types of information?
- Will the adoption of new information technologies require Extension to make tough choices about the audiences it will serve?
- Should State institutions copyright and franchise their software or do they have an obligation to share it with others?

And perhaps most bacic in the minds of the potential user clientele: At what point in the system may an individual gain access to desired information, from which resource, and at what cost?

A number of vital institutional issues will have to be faced, both in the Congress and the sundry implementing agencies comprising the Federal-State-local triad, including these three specific concerns that were identified in dhe Subcommittee booklet prepared for distribution during the hearing: 4/

> First, the appropriate role for the Federal government in information technology research and development merits reevaluation in view of changing conditions.
> Second, the role of Federal and State agencies in training personnel to use the new technologies should be defined.
> Third, the development of approaches to improve cooperation between the various Federal and State agencies involved in information technology deserves consideration.

3/ U.S. Libraby of Congress. Congressional Research Service. Computer-Based Information Systems and Services for Rural America. A pamphlet produced by Robert L. Chartrand and A. Barry Carr for Hearings held by the Subcommittee on Department Operations, Research and Foreign Agriculture of the House Committee on Agriculture, May 19-20, 1)82, p. 6

4/ Chartrand and Carr, Computer-Based Information Systems and Services for Rural America, p. 7.

Repeatedly, there is an emphasis on raising the level of governmental performance: planning, programming, monitoring, budgeting. In The Recovery of Confidence, John Gardner stresses that: 5/

> . . we must build into organizations, particularly in government, the evaluative processes that will permit us to judge performance. This means that government officials must be required to be specific about goals --that is, about outcomes that would have to be achieved to count a given activity successful; they must develop measures to determine whether those outcomes have occurred; and they must apply the measures systematically to performance--all to the end that they can say of any program, "It worked" or "It didn't work." [italics added]

The Evolving Role of Information Technology

A parallel pattern of change with far-reaching ramifications, including some for the agricultural community, has been that brought about by the cascading improvements in "information technology"--computers, telecommunications, microforms, word processors, audio and video devices. During the past half-century, the impacts of these often astonishing tools and techniques have been felt in every segment of our business and personal lives. Listen to the optimistic prognostication of David Sarnoff, President of the Radio Corporation of America as he spoke in 1927 of one such invention, "radio-television:" 6/

> The possibilities of the new art are as boundless as the imagination. But this much is certain: in the sphere of communication man will forever seek a medium of transmission in pace with his thoughts and desires.

5/ Gardner, John W. The Recovery of Confidence. New York, Norton, 1970. p. 40-41.

6/ Remarks of David Sarnoff, President of RCA Corp., before the Chicago Association of Commerce, June 8, 1927.

Another form of "electronic information processor" soon was to join the array of "wizard machines," and its potential is noted in these modest words of computer pioneer Samuel Alexander, in 1952: 7/

> They may enable science, industry, and government to tackle large-scale complex problems which heretofore could not be handled very effectively in the time allowed. They may eventually reduce the necessity for centralization and attendant overcrowding by permitting the dispersal of people and equipment without sacrificing some of the advantages of centralized control.

The outreach and information access afforded by these technologies, often used in combination, epitomize the changing nature of our society. The "Information Age" has arrived, and institutions and individuals everywhere are striving to understand and cope with it. The dynamic nature of this "information revolution" can hardly be overstated for even as successive groups of hardware or software appear on the scene, the full impact of other recent innovative products or systems such as direct broadcast satellite (DBS), cable services, and fibreoptics or lasers is yet to be absorbed. The introduction of such innovatory devices or methods places stresses upon existing relationships and routines; in this regard, the words of Robert Boguslaw in The New Utopians merit recall: 8/

> Computers are not found in nature. They have to be built. And they must take their places within a framework of existing social systems. A decision to place them within a framework redefines existing system arrangements in significant ways.

7/ Remarks of Samuel N. Alexander before the Eastern Joint Computer Conference, 1952.

8/ Boguslaw, Robert. New Utopians. Englewood Cliffs, N.J., Prentice-Hall. 1965. p. 182.

Information technology can perform many useful services for those who comprise the rural community:

- Speeding the transmission of information from the creator to the user;
- Sifting selectively, according to user profiles, through vast quantities of available information to obtain the most relevant material;
- Storing information, and in some cases raw data, so that concept terms and "keyword" indexes will allow rapid, precise retrieval; and
- Facilitating the dissemination of needed information to individual and organizational users in the most expeditious fashion.

The importance of public investment in the production (research) and dissemination (education) of key knowledge is underscored in a recent paper 9/ by Nobel Laureate Economist Theodore Schultz. Entitled "Knowledge is Power in Agriculture," it stresses the criticality of promoting agricultural growth by improving the quality of farm people as economic agents. Those responsible for agricultural productivity must, in the present setting, draw upon the valuable lessons of the past even as they are stretching their horizons into the future. Bruce Catton wrote that: 10/

> Americans were a people of whom much had been asked and to whom much had been given, and their rendezvous with destiny had fairly started--an ongoing destiny, to be partaken of and defined and applied in different ways by each generation in turn.

9/ Schultz, Theodore. Knowledge Is Power in Agriculture. Challenge, September-October 1981. p. 1-12.

10/ Catton, Bruce and William B. The Bold and Magnificent Dream. Doubleday, 1978, Garden City, New York. p. 465.

Today, the debate centers increasingly on the best means of obtaining needed data--market, weather, pest-oriented, etc.--and the trade-offs inherent in acquiring technology-supported information services. The technologies now being tested or used operationally to disseminate information to more remote areas are only the leading edge of systems already under development. Significant, proven advantages have been derived from the miniaturization of components in computers and telecommunications and an unremitting trend toward less costly configurations.

Many misconceptions can arise regarding the efficacy and utility of external information which is made accessible to the farming community. No magic is wrought by the collection, either within government or as an entrepreneurial endeavor by a private sector "information provider," and possible subsequent interpretive handling of narrative, graphic, or statistical information. Norman Cousins cautions that: 11/

> . . .in a computerized age. . .there may be a tendency to mistake data for wisdom, just as there has always been a tendency to confuse logic with values, and intelligence with insight. Unobstructed access to facts can produce unlimited good only if it is matched by the desire and ability to find out what they mean and where they would lead..

Interactions Involving Agriculturalists and The Information Community

In contemporary America, there are several focal developments which embody key facets of interaction between farmers and ranchers and those entities who are responsible for acquiring, indexing, abstracting, storing,

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11/ Pylyshyn, Zenon W., ed. Perspectives on the Computer Revolution. Englewood Cliffe, N.J., Prentice-Hall, 1970. p. 499

processing, retrieving, and disseminating selected information of proven value to that user community:

- During the 1970s counties with no settlement as large as 2,500 persons and not adjacent to a metropolitan area grew by 14.6 percent, faster than the metropolitan growth rate; the rural population increased by 5.9 million persons. 12/
- Although the emphasis on productivity has continued unabated, and technologies have been utilized to that end to the utmost, there appears to be a growing feeling that the role of technology-supported information services can become critical in improving the management and hence the productivity of farming units.
- For those living at "the end of the road," who often see themselves as being informationally disadvantaged, any move toward establishing a better balance in the offering of advanced information services is viewed with enthusiasm, although this may place new burdens on Federal services and local government.
- The "internationalization" of American agriculture, which had its genesis nearly a decade ago, has included the creation of an awareness on the part of the American farmer--through such services as AGNET--of market opportunities akin to those exising in an adjoining county or State in earlier periods.

Since new information systems are generated as the result of a clearly urgent need as expressed by the users, or come about due to an entrepreneurial belief that there is a market for them, experience has shown that their usefulness should be assessed regularly. In his book Society as a Learning Machine, former Science Advisor to the President Dr. Jerome Wiesner pointed out that "any learning process requires feedback of information for a comparison of the accomplishment with the goal." With the advent of on-line technology, this monitoring can be achieved much more easily than in the past.13/

12/ Long, Larry, and Diana DeAre. Repopulating the Countryside: A 1980 Census Trend. Science, v. 217, September 17, 1982. p. 1112, 1114

13/ Wiesner, Jerome. Society As a Learning Machine. The New York Times, April 24, 1966. p. 15

The technologies now being used operationally to disseminate information to more remote areas are but the leading edge of more advanced systems. With the impressive advantages gained through the miniaturization of components, both in computers and telecommunications, and the continuing trend toward less expensive configurations, the number of individuals and organizations able to purchase or lease the new systems grows apace. Government and society alike are being changed as a result of these developments. A thought-provoking observation on this phenomenon was made by the late Marshall McLuhan:14/

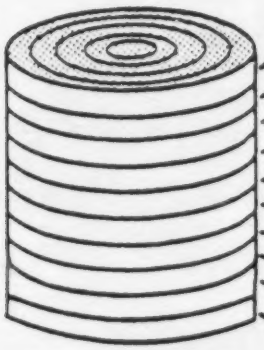
> The medium, or process, of our time--electronic technology--is reshaping and restructuring patterns of social interdependence and every aspect of our personal life. It is forcing us to reconsider and reevaluate practically every thought, every action, and every institution formerly taken for granted.

It is apparent to those developing as well as using the evolving information resources and services that the integration of the new devices and techniques into established routines will take time, and in many instances will cause unanticipated changes in the ways of doing things. This calls for careful thought to be given to the scope and nature of the orientation [illegible] new users first hear and learn about how the systems work, [illegible] of them as users, and to whom they can turn for assistance [illegible]cur. The importance of good training and follow-through user [illegible]dures can never be overstated.

14/ McLuhan, Marshall. The Medium is The Message. Bantam Books, New York, 1967. p. 8.

The Stakeholders Involved in Advanced Information Systems for Rural America

Any examination of the groups involved in the creation, maintenance, and utilization of technology-based information services designed to support the farming and ranching communities reveals a diverse set of private and governmental institutions, as well as individuals and families. These include:



- Individual or family-owned farms and ranches
- Agri-business corporations
- Newspapers
- Television and radio stations
- Banks
- University and college agricultural departments
- Town and county governmental units
- Telephone and satellite utilities
- Federal, State and local extension services
- Associations and farm organizations

Each of these has a special stake in the effective introduction and functioning of better rural information systems. Quite often, there are interlocking activities which, if properly carried out, can serve to benefit several of the participating groups simultaneously. There will be times when communication--in the traditional sense--will be improved, perhaps to the same extent as when the telephone became widely used. In terms of the marketplace, particularly the handling of crops and livestock, the timeliness of information afforded by these services can be vital.

Just having more information is not, of course, the answer to everyone's problems, but new action alternatives are coming to light. Those with a real need for better (and sometimes more) information must be ready to go through an "education" process of sorts. This may involve a shift in priorities, including how time is spent and specifically what types of information are critical to the management of their operation. Any change involves an element of risk, but as Peter Drucker (in Management Science) counselled nearly 25 years ago: ". . . while it is futile to try to eliminate risk, and questionable to try to minimize it, it is essential that the risks taken be the right risks."15/ The responsibility for determining priorities and program thrusts is one which will necessarily be shared by an array of organizations in both the public and private sectors.

15/ Drucker, Peter F. Long-Range Planning: Challenge to Management Science, in Management Science, v. 5, 1959. p. 240

II. INFORMATION TECHNOLOGY AND ITS APPLICATION IN AGRICULTURE

When the European settlers established their first colonies on the shores of America in the early seventeenth century, they brought with them the tools, seeds, and agricultural technology of the old world. In their first contacts with the native American Indian, they were exposed to the tools, seeds and agricultural technology of the new world. The older colonies in New England and Virginia became the first "experiment stations" where the old and the new were tried and proven, and the practical information thus obtained was sought by and shared with settlers at the newer colonies.

In the earliest days information was exchanged among farmers, and almost all of the settlers lived on small farms. That is to say, people traveled from place to place obtaining needed supplies and information on a one-to-one basis. Hand-carried letters were another means of transmitting information. Newspapers eventually became the first mass media, and given the nature of the times, agricultural information was a prominent feature of these publications. In the late eighteenth century, books--for example, The Old Farmers Almanac, published in Sterling, Massachusetts, in 1792--became important sources of agricultural information. The American Farmer magazine, which began publication in Baltimore in 1819 at a cost of $4.00 per annum, stated its purpose: "to collect information from every source, . . . to enable the reader to study the various systems, . . . and to put him in possession of that knowledge and skill." Besides articles on the main subject of the paper, it promised original essays "for amusement and instruction, substantial detail of passing occurrences--and . . . a faithful account of the actual prices" of principal farm commodities for sale in the Baltimore market.

It seems worth pointing out that the explosion of publications in early America was certainly facilitated by the use of a common language--English. Although many tongues were spoken by early Americans, and early publications reflected such diverse readerships, English rapidly became the universal language. Computer-based information systems have not had the advantage of a universal programming language.

Americans early expressed an interest in science. The American Philosophical Society, the first significant scientific society in America, was founded in 1743. The first society devoted entirely to agriculture was the Philadelphia Society for Promoting Agriculture, formed in 1785 by a group of citizens, only a few of whom were actually farmers. Many local agricultural societies were thereafter organized throughout the United States.

The beginning of involvement in scientific agriculture by the U.S. Government is traced to activities of the U.S. Patent Office in 1839 when the Congress appropriated $1,000 for collecting agricultural statistics, conducting agricultural investigations, and distributing seeds. The agricultural collections of the Patent Office library are said to be the beginnings of the National Agricultural Library, now maintained by the U.S. Department of Agriculture. By 1859 there was general dissatisfaction on the part of the Congress and the public with the activities of the agricultural department of the Patent Office. President Lincoln's first annual message to the Congress suggested that "annual reports exhibiting the condition of our agriculture, commerce and manufactures would present a fund of information of great practical value to the country." Congress responded the following year with an act establishing the U.S. Department of Agriculture. The Act of 1862 instructs the USDA to "acquire and diffuse among the people of the United

States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word."

At the same time Congress was establishing the U.S. Department of Agriculture, it began a series of Acts which collectively created the Land-Grant University system. The Morrill Act of 1862 provided land or funding to each State to endow, support, and maintain at least one college to teach, among other subjects, agriculture. This was followed in 1887 by the Hatch Act which established State agricultural experiment stations for the purpose of "acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture." Additional funding was provided to States by the Second Morrill Act of 1890, for the establishment of a separate college "for the education of colored students in agriculture and the mechanical arts." And finally, the Smith-Lever Act of 1914 created a Federal-State-local government partnership to carry out a program of extension work designed not only to diffuse useful and practical information relating to agriculture and home economics, but also to "encourage the application of the same."

Although mass media were being provided an ever-increasing stream of information from Federal agencies, State universities, and other sources, the problem of serving a geographically isolated farm population with timely information still remained. Initially farm families could only receive newspapers and magazines when they visited the nearest large town or city.

The first step toward bringing the world to the farm came when Postmaster William L. Wilson ordered that mail would be delivered directly to farm homes. Rural free delivery (RFD) began in 1896 in West Virginia and was enlarged to include all rural residents, as successive Congresses provided funds. This meant

that newspapers, magazines, and books could be sent directly to rural residents and at very low cost.

Although Alexander Graham Bell invented the telephone in 1876, it was many years before its benefits were fully available to rural residents. Again it was geographic isolation, and the dispersed nature of farm population, which caused the private sector to consider telephone service to rural areas an unprofitable business investment. In the early days farmers banded together to form small, mutual (cooperative) telephone companies to serve their areas.

Soon, however, the heavy capital costs associated with a modern telephone network were beyond the means of most rural telephone systems. The poor service caused by equipment obsolescence was a major problem. Fewer farmers had telephones in 1940 than in 1920. In 1949, Congress authorized an agency of the USDA, the Rural Electrification Administration (REA), to make loans "to assure the availability of adequate telephone service to the widest practical number of rural users." At that time only 38 percent of all farms had telephone service.

Although the first successful radio station, KDKA Pittsburgh, went on the air in 1920, the full benefits of radio, and later television, could not be available to farmers until their homes were electrified. In 1920 almost no farms were served by electric utility companies. According to the 1930 census, 9 percent of the farms were served by utility companies and another 4 percent generated their own electricity.

Because of the low density of farm population, farmers were charged higher rates for electrical service, and the extension of service was slow. In 1935 President Franklin Roosevelt established REA by Executive order for the purpose of making loans to local organizations to finance the distribution, generation,

and transmission of electric power to unserved rural persons. Although nearly half of all farms and ranches still lacked electrical service by the end of the Second World War, today 99 percent of all farms receive electrical service.

The first all-purpose, all-electronic computer was developed in 1946, but commercial computers did not begin to appear on Land-Grant University campuses until about 1960. Agricultural research and Extension workers were among the first to use this new technology. By the early 1960s, a number of state universities had in operation computer-based recordkeeping and farm management programs for farmers, and linear programming models were being used on a regular basis. This early exposure of farmers to computer information management set the stage for the ready adoption of terminals and personal computers on the farm in the 1980s.

Current Information Technology in Agriculture

In focusing on the application of current information technology to a range of farm-related activities, it is helpful to delineate the types of information which are normally used in the daily personal lives and business operations of those who farm and ranch:

1. News and community service information--what's happening;
2. Weather forecasts and related emergency or disaster information;
3. Crop and livestock production information, including pest management, irrigation water management, and feeding recommendations;
4. Marketing information, including current and future prices;
5. Selling of farm products through teleauction or computer auction
6. Purchasing farm and home supplies, including teleshopping;
7. Banking services, including lending and cash management;

8. Business management including recordkeeping, budgeting, and planning;

9. Information concerning farm and public policy including regulations; and

10. Personal education and entertainment.

Farm families have available to them an unprecedented variety of sources of information and services such as those just listed. One major type of information service is the public or tax-supported sector, consisting of Federal, State, and local agencies. The USDA is still a major source of technical information about the production and marketing of farm commodities as well as home economics. The National Weather Service of the U.S. Department of Commerce collects, interprets, and distributes weather data. State agencies and institutions, including the research and extension components of the Land-Grant Universities, and the Crop Reporting Services, are also an important source of production, management, and marketing information. At the local level, libraries, county Extension Offices, and the local school system, including community colleges, are major sources of information. Local institutions tend to be places where information from other sources is stored and retrieved for local users, or where information is conveyed through formal educational processes such as group lectures.

A second major category of information service is the private sector. Here, businesses or not-for-profit organizations provide information for a fee which may be paid by the user or an advertiser, or shared by both. In some cases private sector information sources are called mass media because the individual has no direct control over the content of the information presented; for example, newspapers, magazines, radio, and television. Mass media can make large quantities of information available to large numbers of people at a low cost per person.

However, it is often not a simple task for the user to sift through this mass to obtain the particular information desired.

When a National Opinion Research Center survey asked farmers if they were dissatisfied with their current sources of information, their most frequent complaint involved a lack of confidence in accuracy and reliability. Information received from government sources was sometimes felt to be politically slanted. Available information often did not apply to the particular type of farm or geographic area, was too general or vague, too old or outdated, or it was too costly or difficult to obtain. Yet in spite of these complaints, most farmers expressed the belief that their production and marketing problems could be alleviated if they had access to the specific information they needed.

With the advent of computer technology, and associated data transmission technologies, it has recently become feasible to offer users direct access to information bases from remote locations such as their home or office. Some of these information bases may contain a narrow range of data related to a specific topic, as for example the CRIS system which lists agricultural research currently in progress. Other systems may offer large collections of data bases networked for access through a single service, as for example The Source system or AGNET. But in either case, users, equipped with a terminal or personal computer to access the system's main computer and a printer or a tube to display the results, can quickly search huge collections of data, retrieve what is useful, and carry out whatever manipulations of the data are necessary to answer their questions or solve their problems.

Farmers who have purchased computers agree that the biggest problem is finding useful programs. For while minicomputers are within the price range of most

farmers, without proper programming the units are of little value. Systems should provide more than just basic information. Successful systems also provide the means for analysis of information in ways which assist farmers in their management decisions.

It takes not only hardware and software, but also human and financial resources to build and market a viable computer-based information system. Because there are significant costs associated with the development and maintenance of computer-based information systems, users are usually charged a fee before access to the system is granted and a second fee based upon the extent of their usage. These costs have often discouraged commercial firms, leaving the burden of development to State universities and government agencies. However it can be expected that, as the technology is perfected, the private sector will play an increasingly important role in computer-based information systems.

What Does the Future Hold?

The computer-based information revolution in agriculture is based upon three major forms of technology:

1. Interactive computer systems which involve medium to large computers with powerful computational and information access capability. Users are usually connected to the main computer via terminals and telephones.

2. Videotex systems involving small to medium computers designed to provide a wide range of information. Users require a video device provided with a terminal and telephone system.

3. Microcomputer systems on site in offices or homes can meet the data processing needs of most users in addition to interfacing with large time-sharing systems and many videotex systems. The availability of quality software is important.

New information technology is changing the form in which farm families receive information. Increasingly, information is being brought to the user, via

terminal or television; the user no longer has to go to the information. Formal courses can take place in the home instead of the classroom. Lectures can be replaced with programmed learning sequences on terminals. Even the tried-and-true Extension demonstration can be videotaped and made available to farm families in their homes and at their convenience. More and more, Extension bulletins and research reports, as well as magazines and even newpapers, will be available as videotex on home television rather than delivered in hardcopy. Even person-to-person communications now limited to personal visits, telephone or letter, will be handled--when speed and convenience are important--through "electronic mailboxes" provided by many computer-based systems.

The penetration of computer-based information technologies into the farm scene raises some vexing social questions. The basic policy issue is: At what point in the system may an individual gain access to desired information, from which source, and at what cost? Promoting equality in this dimension is a major challenge for both public and private sectors. The emergence of new information technologies may also have important consequences for traditional agricultural information institutions. Will the new information systems be used to increase the capacity of the county Extension service to serve farm and nonfarm clients, or will they replace the traditional Extension delivery system for certain types of information? Should State institutions copyright and franchise their software, or do they have an obligation to share it with others? Will the important role of farm magazines and other publications be diminished?

Much has been written about the present "Age of Information" and the emphasis has been on the array of electronic devices which can store, process, retrieve and distribute information at incredible speeds and in a variety of forms. Literally hundreds of people at universities, on farms, and elsewhere are at work developing

software and data collections to utilize this technology. One can hardly pick up a farm magazine today which does not contain an article about computers for the farm. Dr. Robert Kramer, of the Kellogg Foundation, predicts that three-quarters of the commercial farms and 90 percent of the county Extension offices will be equipped with computers or intelligent terminals by 1990. While this prediction may seem far-fetched to some people, the information technology revolution is impacting the farm sector right now. The electronic technology already exists.

III. CHRONOLOGY OF SELECTED EVENTS

Although information technology has been evolving since the dawn of civilization, many persons believe that recent developments indicate an "information revolution" is underway. A brief review of significant events is helpful in developing a perspective on where agricultural information technology is today, and how we got here. The following is a selected sampling of significant events in the history of the United States, including recent Federal initiatives, that have influenced the utilization of new information systems in American agriculture.

1743 The American Philosophical Society, the earliest society in the United States to promote scientific agriculture, is organized.

1785 The Philadelphia Society for the Promotion of Agriculture is founded.

1790 The New England Farmer by Samuel Dean, which became a standard textbook on American agraiculture, is published.

1792 The Old Farmers Almanac is founded and published by Robert Thomas at Sterling, Massachusetts. It is one of the oldest running periodicals in the United States.

1819 The American Farmer magazine begins publication in Baltimore.

1831 Many schools and colleges begin to offer courses in agriculture and sciences helpful to agriculture.

1837 Samuel Morse develops the first practical telegraph machine and filed for a patent.

1840 For the first time the U.S. Census includes questions on agriculture.

1858 First successful trans-Atlantic telegraph cable completed.

1860 First pony express mail route between St. Louis and Sacramento.

1875 Frank Baldwin is granted first U.S. patent for a practical calculating machine that performs the four arithmetic functions.

1876	Alexander Graham Bell invents the telephone.
1881	First long-distance telephone line placed into service between New York and Chicago.
1895	Guglielmo Marconi invents the wireless telegraph (radio).
1896	Postmaster William L. Wilson orders rural free delivery (RFD) of mail.
1920	KDKA (Pittsburgh) becomes first successful radio station.
1925	Charles Jenkins invents the television.
1935	President Franklin Roosevelt establishes Rural Electrification Administration by executive order.
1946	Eckert and Mauchly invent and develop first all purpose, all electronic digital computer, the Electronic Numerical Integrator and Calculator.
1955	Transistors perfected which replace vacuum tubes and improve speed and efficiency in moving electrons.
1958	Computer tabulated farm record/management systems begun by Michigan State University and several other Land-Grant Universities.
1960	Tiros satellites send back pictures of hurricanes and cloud movements.
1969	TELPLAN information system implemented by Michigan Extension Service.
1973	Low cost, limited capacity "micro-computers" are introduced.
1974	Chase Econometrics markets simulation model of U.S. agricultural economy.
1975	TELCOT system for computerized marketing of cotton begins with 15 buying terminals in Lubbock, Dallas, and Memphis.
1975	AGNET information system established at University of Nebraska.
1976	National Agricultural Library combines all bibliographic data bases into on-line AGRICOLA system.
1977	Regional Energy Environment Information Center established at Denver Public Library.

1980 Computerized system for sale of livestock begun by Electronic Marketing Association with 23 terminals throughout the Eastern seaboard.

1981 Iowa Beef Processors establishes a satellite voice communication system.

1982 U.S. Department of Agriculture begins electronic dissemination of news releases and reports.

1982 Federal Communications Commission adopts interim rules for the licensing and operation of direct broadcast satellite.

Congressional Initiatives

1839 Congress appropriates $1,000 to the Patent Office for collecting agricultural statistics, conducting agricultural investigations, and distributing seeds. Library is begun which later becomes the National Agricultural Library.

1862 President Abraham Lincoln signs legislation which created the U.S. Department of Agriculture.

1862 President Lincoln approves the Morril Land-Grant College Act.

1887 Hatch Act establishes State Agricultural Experiment Stations.

1914 The Smith-Lever Act formalizes cooperative extension work.

1949 Congress authorizes Rural Electrification Administration to make loans to rural telephone companies.

1968 Vocational Education Act (P.L. 90-576) provides basis for subsequent communications demonstration experiments.

1972 Rural Development Act (P.L. 92-419) establishes pilot program for rural development and small farm research and education to be administered through the Land-Grant Institutions.

1977 Federal Program Information Act (P.L. 95-220) transfers Federal Assistance Program Retrieval System (FAPRS) from USDA to OMB.

1977 Subcommittee on Communications of Senate Committee on Commerce, Science and Transportation holds hearings to examine potential applications of telecommunications technology.

1978 Public Telecommunications Financing Act (P.L. 95-567) establishes Public Telecommunications Facilities Program.

1980 Paperwork Reduction Act (P.L. 96-511) strengthens agency information management procedures.

1982 House Subcommittee on Department Operations, Research, and Foreign Agriculture holds hearings on computer-based information systems for agriculture.

IV. ILLUSTRATIVE INFORMATION SYSTEMS FOR AGRICULTURE

As with many sectors of the U.S. economy, farm income is often dependent upon the availability of accurate, up-to-date information necessary for effective decision-making. There exists in the United States today a wealth of information on agriculture and related subjects, along with an expanding foundation of computer-based systems and telecommunications networks to process and distribute these data. Yet in many instances, these information delivery systems are not easily accessible to all members of the agricultural community, particularly limited-resource farmers.

In recent years, Extension agents, farm associations, and USDA officials have expressed growing concern over how to correct this imbalance through the timely delivery of low-cost information to all of the Nation's farmers and ranchers. Despite a wary attitude on behalf of the agricultural community, the momentum for providing computer-based information services to the agricultural sector is steadily increasing as farmers are realizing the financial advantages to be gained by integrating these systems into their operations. Currently, both the public and private sectors are becoming actively involved in the development of on-line agricultural databases, farm management software, electronic trading systems, videotext systems, and electronic messaging networks. A selection of systems demonstrating these various applications appears in Section A. Section B contains a comprehensive listing of operational and experimental agricultural information systems in the United States, followed by a map depicting the centers of operations for these programs. (Figure 2)

A. Selected Systems Demonstrating Various Technological Applications

1. Interactive Systems with Farm Management Software

AGNET - This "Agricultural Network" is a time-sharing information delivery system designed to furnish management analysis of complex agricultural problems on the basis of field experience and knowledge of current research findings. Developed in 1975 by Dr. James Kendrick and Dr. Thomas C. Thompson of the University of Nebraska, AGNET currently contains more than 200 programs which are accessed by subscribers in more than 40 states. The problem-solving capability of the various programs offers assistance in such areas as livestock and crop production, grain handling, marketing and finance, and home economics. For example, a specific program can manipulate an individual farm's records to analyze the cost and return for feeder cattle. Another important feature is the electronic mail or message relay system; the MAILBOX program allows the sender to route communications to a single user or a predefined list of users. AGNET also provides access to USDA crop and livestock reports as well as trade leads issued by the Foreign Agricultural Service.

Besides the cost of a portable computer terminal, most users spend about $10 per hour for computer use. This cost is based on a charge for being connected to the computer plus a charge for processing time. Any regular telephone line can be used to access AGNET, although long distance telephone charges may cost two to three times the amount spent for computer time.

CMN - Developed by the Virginia Polytechnic Institute and State University as a national information system for use by State Extension services, the "Computerized Management Network" assists Extension workers in solving problems, retrieving information, and evaluating programs. To date, many CMN programs have provided the foundation for several highly successful Extension services.

Two of the most popular are: the Simplified Dairy Cattle Feeding Program which has had a substantial impact on the economics of feeding dairy herds; and the OUTLK program which provides user access to USDA's Computerized Outlook Information Network (COIN), a system containing the Department's crop and livestock reports. The CMN system is designed to be used by non-computer trained individuals and is currently accessed by more than 500 users in 44 states and Canada.

Honeywell's time-sharing system, DATANETWORK, supplies computer and communications support for CMN users; subscribers access the system with computer terminals via telephone lines. The costs of running CMN programs vary from $0.50 for very simple problem-solving to $15 for complex linear programming models. The charge for terminal connect time in the United States is $18 per hour. Generally, light usage of the CMN system costs $15 per month, while moderate and heavy usage averages $50 per month and $300 per month, respectively.

2. Electronic Trading

EMA - Electronic auctioning for U.S. agricultural products originated with trading conducted via conference telephone calls in the 1960s -- one of the early "teleauctions" sold slaughter hogs from Virginia to meat packers in Virginia and nearby States. 16/ Since then, electronic trading has expanded to include more sophisticated computerized systems which can handle a higher volume of trading as well as bookkeeping functions. An example of this type of system is the Electronic Marketing Association, Inc. of Christiansburg, Va., which held its first computerized auction for livestock in 1980. The members of this non-stock corporation had earlier participated in a pilot electronic trading program which resulted in higher prices for livestock and a decrease in the costs of marketing.

16/ U.S. Department of Agriculture. Agricultural Marketing Service. The Feasibility of Electronic Marketing for the Wholesale Meat Trade. AMS 583, May 1979. Washington, 1979. p. 24.

Through a telephone hookup to computer terminals in any location, buyers and sellers are brought together at a specific time to determine the price, on a competitive basis, of the animals being offered for sale. The EMA system permits prospective buyers to obtain written descriptions on the animals several hours before sale time. During the auction itself, the computer drops the asking price until a bid is received, then continues upward from that point. At the end of a sale, a high bidder receives a summary of his purchases plus a summary of the entire sale. Presently, EMA is providing computer auction services not only to the Eastern Lamb Producers Association of Virginia, but also to two other lamb marketing cooperatives located in Wisconsin and Indiana.

3. Videotext

Green Thumb - Green Thumb, an experimental videotext project funded by the U.S. Department of Agriculture and the National Weather Service, began operation in two counties in Kentucky in March 1980. Two hundred participants received decoders which were connected to their home television sets and telephone lines and were used to enter and receive information from microcomputers in the counties' Extension offices. (See Figure 1). From a "menu" of options, farmers could retrieve data on weather, futures prices, and market conditions through a variety of information providers including the Chicago Board of Trade, the National Weather Service, and the USDA Agricultural Marketing Service. State and county Extension agents could also enter information of local interest such as home economic features or 4-H Club activities. Weather updates ranged from an hourly to daily basis, while renewal of crop and livestock futures' data was scheduled every 15 minutes but generally occurred every 30 minutes. By far the most frequently-requested categories of information were marketing and weather.

At the end of the Green Thumb experiment in July 1981, the Stanford University Institute for Communication Research and the University of Kentucky College of Agriculture each studied the impact of the videotext project on the farmers'

agricultural operations and assessed the technical aspects of the system. While users found the overall system to be workable, about half of the farmers experienced technical problems and two-thirds reported inadequate updating of information; thus, farmers tended to rely on more conventional sources of information such as newspapers and radio broadcasts. Due to these findings, efforts have been made to improve the reliability of the Green Thumb system. Currently, a videotext service is being offered to 20 farmers in Davis County, Kentucky under the direction of the Kentucky Cooperative Extension Service. The project will be evaluated during the next few months to determine if reliability has improved and if the program should be continued.17/

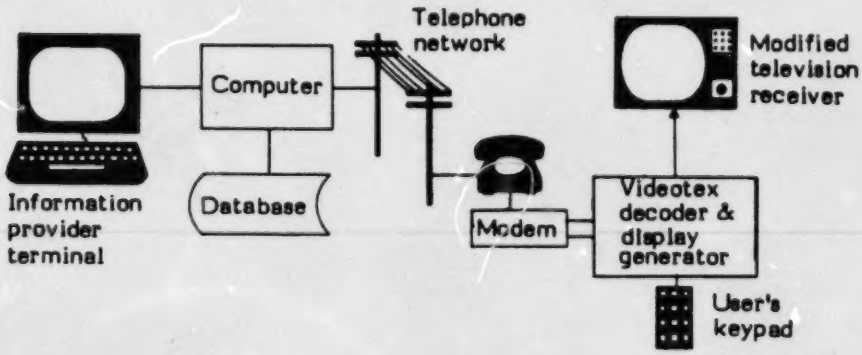


FIGURE 1.-- Videotext via telephone line. 18/

17/ Ragland, John. University of Kentucky. Cooperative Extension Service. Telephone interview. July 26, 1982.

18/ Tydeman, John, and others. Teletext and Videotex in the United States: Market Potential, Technology, Public Policy Issues. (Institute for the Future, Menlo Park, Calif.). New York, Data Communications, McGraw-Hill, 1982. p. 5.

4. Electronic Messaging

USDA Electronic Mail Network - Based on the positive results of a year-long test, the Governmental and Public Affairs of USDA began electronic dissemination of the Department's news releases and current reports through the DIALCOM electronic mail service in January 1982. The system was adopted in response to the need for more efficient communications between USDA and the Land-Grant University system and the State departments of agriculture; prior to the acceptance of DIALCOM, USDA officials relied on surface mail and telephone facsimile, both of which proved to be somewhat unsatisfactory for the rapid transmission of current information. Through the electronic mail service, an individual can send a message to the receiver's "electronic mailbox" where it is stored until that person is ready to receive and read the information. Additionally, the DIALCOM service provides the capability of handling automatic distribution lists as well as providing access to United Press International's national and international news files.

The USDA electronic mail network supplies several categories of information. USDA ONLINE offers the "News" file, which contains nationally significant news releases, along with summaries of the various "outlook and situation reports" issued by the Economic Research Service and the "highlights of crop and livestock reports" issued by the Statistical Reporting Service. Another file, "FAS Reports", provides the Foreign Agricultural Service's weekly roundup of world agricultural production and trade. FAS trade leads, along with the "News" segment of USDA ONLINE, are transmitted to the University of Nebraska's AGNET system. 19/ Plans are underway to include the full texts of crop, livestock, and outlook reports on the DIALCOM system; these USDA reports are generated under the name of COIN (Computerized Outlook Information Network) and are available on the CMN

19/ U.S. Department of Agriculture. Office of Governmental and Public Affairs. Report on U.S. Department of Agriculture Electronic Information Exchange and Dissemination. July 1982. Washington, 1982. p. 7, 12.

system under the OUTLK program. The USDA electronic mail network will not necessarily replace traditional methods of information dissemination such as printed publications and radio broadcasting tapes. Rather, its purpose is to enhance the effectiveness of USDA information distribution by offering farmers and State and local agricultural officials a means of obtaining USDA reports and news releases as soon as they are announced.

B. Operational and Experimental Systems in U.S.

Operational

System Name	Sponsoring Organization	Location	Information and Services Provided	Key Contact and Phone Number
AACSys	American Farm Bureau Federation	8 State Farm Bureaus and participating members	. information retrieval: market data, weather, pest management, legislative developments, . specific advice from market analysts	Mr. Kim Wells 312-399-5770
AGNET	U. of Nebraska	more than 40 States	. problem-solving for farm management . information retrieval: USDA reports on crops, livestock, markets, trends, and trade leads	Dr. James Kendrick 402-472-2033
AGRICOLA	USDA/NAL	nationwide	. information retrieval: bibliographic citations to books, journal articles, govt. reports in field of agriculture	Mr. David Hoyt 202-334-4248
ANSER	U. of Kentucky	25 Extension offices in Kentucky	. problem-solving for farm management . information retrieval: socioeconomic data for counties in Kentucky	Mr. John Byars 606-257-3335
Chase Econometrics Domestic Agricultural Service	Chase Econometrics	nationwide, Canada and Europe	. information retrieval: agricultural statistics, historical data, and forecast information . "Agricultural Model": econometric model for agricultural business analyses	Ms. Donna Falgiatore 215-896-4756
CMN	Virginia Polytechnic Institute and State University	Extension offices in 44 States	. problem-solving for farm management . information retrieval: USDA reports on crops, livestock, and marketing	Mr. Craig Woods 703-961-5184
COMNET	Michigan State University	Extension offices in Michigan	. information retrieval: serves as connecting link to several agricultural computer databases . electronic mail capability	Dr. Steve Harsh 517-355-3776

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System Name	Sponsoring Organization	Location	Information and Services Provided	Key Contact and Phone Number
CRIS	USDA	nationwide	. information retrieval: publicly-supported agricultural and forestry research in U.S.	Mr. Ted Bauer 202-344-3846
Dixie-Style Selling	Alabama cattle marketing associations	7 cattle-selling associations in Alabama	. video-auction with slides	Mr. Dan Linton 205-826-4963
ECI	Egg Clearinghouse, Inc.	160 members nationwide	. electronic trading for eggs	Mr. Frank Koelbrich 603-868-2899
EMA	Electronic Marketing Association	lamb marketing cooperatives in Virginia, Wisconsin, and Indiana	. electronic trading for lambs	Mr. Kenneth Neel 703-382-1781
FACTS	Purdue U.	92 county Extension and 10 area Extension offices in Indiana	. problem-solving for farm management . information retrieval: weather, market prices, emergency information bulletins . electronic mail	Dr. Eldon Frederick 317-494-8396
FANI	USDA	nationwide	. information retrieval: Federal food, nutrition and agriculture programs	Mr. Tom Tate 202-344-3750
INDAX	Cox Cable Communications, Inc.	Omaha, Nebraska	. information retrieval: news, weather, financial data, commodities prices . transactional features: banking, shopping	Mr. David C. Andersen 404-393-0480
Instant Update	Professional Farmers of America, Inc.	nationwide	. information retrieval: market conditions, weather, futures prices . staff analyses and recommendations from PFA	Mr. Stewart Cross 319-277-1278
Iowa Beef Processors Satellite Communications System	Iowa Beef Processors, Inc.	Kansas	. satellite communications system linking headquarters to field buyers in Kansas	Mr. Dean Houle 402-241-2630

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System Name	Sponsoring Organization	Location	Information and Services Provided	Key Contact and Phone Number
NARS	USDA	approximately 30 State Extension offices	• information retrieval: program accomplishments of State Cooperative Extension Services	Mr. Tom Tate 202-344-3750
OSU Farm Management Programs	Oklahoma State U.	nationwide	• problem-solving for farm management	Dr. Ted Nelson 405-624-6081
SCAMP	Cornell U.	30 county extension offices, N.Y. State agencies, 170 private sector users in N.Y.	• information retrieval: pest control and pesticides • simulation model; potato blight and alfalfa weevil • electronic mail: for reporting field observations and retrieving pest management strategies	Dr. Jim Tate 315-787-2208
SCORPIO	Library of Congress	Library of Congress	• information retrieval: citations to books, journal articles, congressional reports in the Library of Congress; abstracts from Congressional Record and information on legislation since 94th Congress	Mr. Jeff Griffith 202-287-8768
THE SOURCE	Source Telecomputing Corp.	nationwide	• information retrieval: Commodity New Service, current business trends, updated listing of stocks, bonds, commodities, and futures • electronic mail	Ms. Jane Brown 703-734-7500
TELCOT	Plains Cotton Cooperative Assoc.	Texas and Oklahoma	• electronic trading for cotton	Mr. Jack Kenwright 806-763-8011
TELETIP	U. of California Cooperative Extension Service	Sacramento Co., Calif.	• telephone access to re-recorded messages on a variety of agricultural topics	Leila Betts 916-366-2013

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System Name	Sponsoring Organization	Location	Information and Services Provided	Key Contact and Phone Number
TELPLAN	Michigan State U.	Extension agents and farm businessmen in over 30 States	. problem-solving for farm management	Dr. Sherill Nott 517-353-4522
Tennessee Telephone Auction System	Tennessee Dept. of Agriculture	Tennessee	. electronic trading for feeder pigs, feeder calves, and yearling feeder cattle	Dr. John Ragan 615-741-1441
USDA Electronic Mail Network	USDA	Land-Grant University system, some State departments of agriculture, and various farm magazines and agricultural news services	. electronic dissemination of USDA news releases and reports over DIALCOM and AGNET systems	Mr. Stan Prochaska 202-447-7454

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Experimental

System Name	Sponsoring Organization	Location	Information and Services Provided	Key Contact and Phone Number
Agrisource	CCA/USDA	nationwide	• information retrieval: provides access to dispersed agricultural databases	Ms. Rita Bergman (CCA) 703-243-8664
CATS	U. of Illinois	Illinois	• electronic trading for wholesale meat	Dr. M. E. Sarhan 217-333-6465
CATTLEX	Texas A & M U.	Texas	• electronic trading for cattle	Dr. Tom Sporleder 713-845-2116
CDC Agriculture and Business Service Centers	CDC	Minnesota	• information retrieval: 'how-to' technology for farming • education: PLATO computer-based courses for small farmers • problem-solving for farm management and personal consulting	Mr. Brian Roth 612-853-6770
DEVELOP	CDC	Minnesota	• information retrieval: identifies sources of technical assistance in areas such as agriculture, conservation, education and housing	Ms. Beth Holmgren 612-853-7895
ESTHL	U. of Maryland	Maryland	• information retrieval: weather, market reports, futures prices, news bulletins • recommendations from Extension Service	Mr. Ralph Adkins 301-454-4848
Farm Market Infodata Service	PBS/USDA	5 test markets nationwide	• information retrieval: commodities prices, market news	Mr. Ben Kittner (PBS 202-488-5129
FIRSTHAND	First Bank System of Minneapolis	Fargo, N.D.	• information retrieval: weather, financial and commodity reports, local and national news • transactional features: banking, shopping • home computing	Ms. Wendy Bollum 612-370-5154

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System Name	Sponsoring Organization	Location	Information and Services Provided	Key Contact and Phone Number
Genetic Profiles	Applied Genetics International	Wyoming	. computer analysis of cattle measurements to determine reproductive efficiency and gainability	Mr. Norm Hayes 307-527-7173
Grassroots	Bakersfield-Californian	San Joaquin Valley in California	. information retrieval: weather, commodities prices, market reports . transactional features: banking, shopping . home computing	Mr. Ron Montgomery 805-395-7222
Green Thumb	USDA	200 farmers in Shelby and Todd Counties, Kentucky	. information retrieval: weather, futures prices, market conditions, local news	Mr. Howard Lehnert 202-447-4681
HAMS	Ohio State U.	Ohio and nearby States	. electronic trading for slaughter hogs	Dr. Dennis Henderson 614-422-2701
IPM in Kentucky	U. of Kentucky	Kentucky	. information retrieval: scouting data on crops and presence of pests, information on each field, pesticides	Dr. Grayson C. Brown 606-258-5638
National Pesticide Information Retrieval System	Purdue U.	pilot project in Illinois, Indiana, Kansas, and Minnesota	. information retrieval: pest control, pesticides	Dr. John Osmun 317-494-4565
Rural Ventures		Princeton, Minn.	. computer-based education and training programs . information retrieval: crop and livestock production, equipment selection . problem-solving and personal consultation in interpreting data	Mr. Robert Rumpza 612-853-3886

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FIGURE 2. — Location of Operational and Experimental Systems.

Operational

System Name	Center of Operations
1 - AACSys	Park Ridge, IL
2 - AGNET	Lincoln, NE
3 - AGRICOLA	Washington, DC
4 - AHSER	Lexington, KY
5 - Chase Econometrics Domestic Agriculture Service	Bala Cynwyd, PA
6 - CNR	Blacksburg, VA
7 - CONNET	East Lansing, MI
8 - CRIS	Washington, DC
9 - Dixie-Style Selling	Auburn, AL
10 - ECI	Durham, NH
11 - EDA	Christiansburg, VA
12 - FACTS	W. Lafayette, IN
13 - FAMI	Washington, DC
14 - IMDAX	Omaha, NE
15 - Instant Update	Cedar Falls, IA
16 - Iowa Beef Processors Satellite Communications System	Dakota City, NE
17 - MARS	Washington, DC
18 - Oklahoma State U. Farm Management Programs	Stillwater, OK
19 - SCAMP	Geneva, NY
20 - SCORPIO	Washington, DC
21 - The SOURCE	McLean, VA
22 - TELCOT	Lubbock, TX
23 - TELETIP	Sacramento, CA
24 - TELPLAN	East Lansing, MI
25 - Tennessee Telephone Auction System	Knoxville, TN
26 - USDA Electronic Mail Network	Washington, DC

Experimental

System Name	Center of Operations
27 - AGRISOURCE	Arlington, VA
28 - CATS	Urbana, IL
29 - CATTLEX	College Station, TX
30 - CDC Agriculture and Business Service Centers	Minneapolis, MN
31 - DEVELOP	Minneapolis, MN
32 - ESTEL	College Park, MD
33 - Farm Market Infodata Service	Washington, DC
34 - FIRSTNAMD	Fargo, ND
35 - Genetic Profiles	Cody, WY
36 - Grassroots	Bakersfield, CA
37 - Green Thumb	Lexington, KY
38 - HAMS	Columbus, OH
39 - Integrated Pest Management in Kentucky	Lexington, KY
40 - National Pesticide Information Retrieval System	W. Lafayette, IN
41 - Rural Ventures	Princeton, MN

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V. RECENT LEGISLATIVE OVERSIGHT

A heightening awareness of numerous governmental and private sector initiatives designed to improve information support for agricultural America, particularly through the utilization of computer and telecommunications technology, caused the Subcommittee on Department Operations, Research and Foreign Agriculture of the House Committee on Agriculture to undertake a series of oversight initiatives during the 97th Congress.

The purpose of these efforts, in the words of Chairman George E. Brown, Jr., included taking "cognizance of probably the most rapidly developing technology in the world and in the United States society...we think it is helpful and constructuve to review this situation as a part of our general responsibility of oversight of agriculture." 20/ The first action, designed to provide a useful insight into an often complex area still in evolution was the development by the Congressional Research Service at the direction of the Subcommittee, a booklet entitled "Computer-Based Information Systems for Rural America" 21/ that was to be used during the two days of formal hearings and workshop sessions, conducted on May 19-20, 1982. Utilizing this background material, and the ensuing contributions emanating from hearings testimony, workshop findings, and other ancillary offerings, a subsequent comprehensive report--"Information Technology for Agricultural America"--would serve as an instrument for viewing broader trends involving information technology as well as setting fort'. delineated options for subsequent congressional action.

20/ Remarks of Rep. George E. Brown, Jr. during hearing on Applications of Computer-Based Information Systems and Services in Agriculture, U.S. House of Representatives, May 20, 1982. Transcript, p. 184

21/ Chartrand and Carr. Computer-Based Information Systems for Rural America. 20 p.

Participants in the 1982 hearings and workshop became fully aware of the Subcommittee desire to ensure that farmers and ranchers had full access to all resources, including an array of technologies, which would allow them to continue making, in the words of Senator Hubert H. Humphrey, "a lasting contribution to our health, to our national prosperity, and to peace in the world." 22/ The needs of the agricultural community for a variety of information--about impending weather conditions, marketplace activities and projections, and factors affecting crop and livestock management--had become increasingly strident, and in many instances appeared to exceed the capacity of existing institutions to provide responsive service. It seemed to some Members of Congress, along with concerned individuals and organizations in many sectors of society, that such requirements, often of gripping urgency, must be confronted and solved. Preparatory to convening the Subcommittee-sponsored sessions, extensive background exploration was undertaken by staff in order to scrutinize existing policies and programs, as reflected in public laws and executive branch promulgations, focusing on this area. In addition, care was taken to examine the genesis of private sector endeavors which had led to the establishment of pilot projects and operational support systems designed to serve the agricultural industry.

Response to the Subcommittee declaration of interest and intent to act prompted a widespread expression of willingness to participate actively in the announced hearing and workshop. Among those who ultimately gave testimony, and led or were involved in the discussion group meetings, were university Extension directors, State and local government representatives, information industry executives, farm organization leaders, senior Federal officials, media management, special information service providers (including librarians), and consultants in information systems analysis and design.

22/ Remarks of Hubert H. Humphrey before the American Agricultural Editors Association, Washington, D.C., June 22, 1966.

Public and Private Sector Perspectives

The viewpoints taken and concerns voiced by these representative elements are illustrated through this random sampling of comments: 23/

> Raymond D. Lett (USDA Senior Executive)-- American agriculture always has been the envy of the world for its basic research and practical application of new production and marketing techniques. A major ingredient in making this system work has been the collection and sharing of information among government and academic sources, private businesses and individual citizens.
>
> John C. Datt (AFBF Administrator)--All parties ought to have equal access to the same government information. And from that point on, then, it is up to each of us to see whether we can package it...and make it meaningful and salable to the membership of our organization.
>
> Dr. M.C. Harding, Sr. (Academic Extension Administrator)--It is estimated that the number of farmers using computers in the next five years will range between five and fifteen percent of commercial farms...management strategies are needed to give guidance to this technological innovation.
>
> Douglas R. LeGrande (Corporate Division Director)--Computers have been successfully used to "model" reality, giving the user answers to "what if" questions, enabling the investigation of alternatives and facilitating decisions which would be most profitable.
>
> Alfred T. Fritts (newspaper executive)--We are not going to offer up a content product in a brand-new business using a whole new presentation and a cost imposition on the farmer without being darned sure that we have a product that will be accessed every day.
>
> Dr. Louis A. Bransford (technology consortium executive) --If we could justify a satellite link, and the average farmer could interface his farm computer to the state extension office, or any one of the agricultural, veterinary or forestry colleges in the United States...the possiblity of decreasing the cost of operation or increasing productivity would become evident.

23/ These quotations were taken from various source documents.

Periodically throughout the two days of hearings, Chairman Brown emphasized that the Committee on Agriculture and "the Congress as a whole," looked for guidance to the participants.

> This hearing and workshop grew out of a perception that information and communications technologies are entering the agricultural sector at a dizzying rate.
>
> The Kellogg Foundation estimates that by 1990, three-quarters of the commercial farms and 90 percent of the county extension offices in this country will be equipped with computers or intelligent terminals.
>
> The application of these technologies holds great promise, but this promise can only be realized if we do an adequate job of planning in the early stages. 24/

The diverse perspectives offered by those participating on a spectrum of technical and user-oriented issues, governmental responsibilities and opportunities, and quandaries facing both the private and public sector, more than met the objectives of the Subcommittee as expressed by Chairman Brown: 25/

1. Provide an opportunity for Members of Congress, their staffs, and activists in the public and private sectors to exchange ideas and experiences in this vital area.
2. Identify and discuss policy and program questions, and obtain realistic recommendations for later initiatives.
3. Increase public awareness of the potential benefits and limitations of advanced information resources and services.

Delineation of Priority Issues

The expectations of the sponsoring Subcommittee were exceeded as a result of the wealth of information that was forthcoming about the information requirements of the user community, basic considerations which must be dealt with in designing and implementing technology-oriented information services, training and system maintenance matters, and future applications of such technology in support of agricultural management and production. A number of specific issues emerged, many of a long-standing nature:

24/ Remarks of Rep. George E. Brown, Jr. during hearing on Applications of Computer-Based Information Systems and Services in Agriculture, U.S. House of Representatives, May 19, 1982. Transcript, p. 4

25/ Chartrand and Carr, Computer-Based Information Systems and Services for Rural America, p. 1

- o Roles of public and private sect[illegible] information providers
- o Concern for protecting the confi[illegible]iality of system data
- o Pro's and con's of hardware and software standardization
- o Conditions governing access to government information
- o Ownership of "value-added" information products and services
- o Local role in determining content of information offerings
- o Responsibility for post-installation system support, including software and file enhancements
- o Government subsidization of research and pilot projects

These and additional issues of note preoccupied the 150 participants throughout the hearing and workshop meetings, and were often evidence of a desire, in the words of Walter Lippmann, to create policies which "reflect a deference to life's ambiguities and to the necessity of practical human accommodation."26/ A listing of the workshop discussion group areas of purview follows:

Group 1 - Private sector information services
Group 2 - Government information services: management and marketing
Group 3 - Government information field operations
Group 4 - User requirements
Group 5 - System implementation: hardware installation, training, maintenance, software and data file modification
Group 6 - Present and projected technology

Identifiable Action Alternatives

The need for action in the near future was stressed many times, with a number of specific action alternatives identified in the findings and recommendations of the discussion groups, as well as appearing in various witness statements:

- o Long-range studies which would attempt to delineate responsive information delivery and access systems;
- o Analysis of existing Extension Service and private sector delivery capabilities, including enhancements featuring utilization of advanced technology;
- o Creation of "clearinghouses" which would centrally store key material, along with requisite indexes, with subject contents of priority value to farmers and ranchers;

26/ Bradley, John P. The International Dictionary of Thoughts. Chicago, Ferguson Press, 1969. p. 659

- o Development of a system that would allow monitoring of the varied information products and services available to the agricultural community, and a means of describing these on-going resources to users;
- o Creation of scenarios, employing dynamic computer models, that could project the impact of information technology on existing agricultural management and marketing tasks;
- o Periodic reviews, through surveys and polls, of user requirements, including those of the smaller family farms and agri-businesses;
- o Simply formatted comparisons of equipment and software products which would enable would-be buyers to understand the benefits and limitations of the devices, program packages, and systems being acquired; and
- o Design of initial orientation and technical training sessions that would allow new system users to grasp the fundamentals of performance in a minimum period of time.

These actions in the 97th Congress are evidence that within the United States Congress there has been a growing concern about the shortcomings involving information services for those living in more remote areas. In the past, hearings were held on salient aspects of rural telecommunications' service, the changing role of rural libraries, and alternatives for providing educational opportunities for inhabitants of areas beyond suburbia. In addition, Members have exhibited interest in the potential of present and projected technologies, particularly computer and telecommunications, for offering a wide range of information products and services to rural citizenry.

Relevant Studies and Congressional Reports

Although relatively few major reports have been issued on this area of burgeoning interest, three are noteworthy:

1978 -- Communications and Rural America, prepared by the Office of Technology Assessment for the Senate Committee on Commerce, Science and Transportation.27/

27/ U.S. Congress. Office of Technology Assessment. Communications and Rural America. Washington, U.S. Govt. Print. Off., 1978

1980 -- National Symposium on Electronic Marketing of Agricultural Commodities, conference proceedings. 28/

1982 -- Report on U.S. Department of Agriculture Electronic Information Exchange and Dissemination. 29/

Two other reports of more than tangential value deserve mention because of their treatment of certain developments in the subject technologies and their application, and the invaluable broader context which they provide:

1978 -- Into the Information Age: A Perspective for Federal Action on Information, prepared by Arthur D. Little, Inc. 30/

1982 -- Public Sector/Private Sector Interaction in Providing Information Services, issued by the National Commission on Libraries and Information Science. 31/

Drawing upon the analytical and factual material embodied in these milestone studies, cognizant congressional oversight groups have been able to delineate an agenda which would lead to a further rewarding exploration of this priority legislative concern. A reflection on the roles of both policymakers and program managers, who must bear the responsibility for shaping the information infrastructure and offerings of the future, is set forth in the volume, Information Technology Serving Society: 32/

> Those who strive to decide which information will or should have residual value--and if television or the printed word is the best means of ensuring that--are doing a great deal of soul-searching where investments in information systems and services are concerned.

28/ National Symposium on Electronic Marketing of Agricultural Commodities, Dallas, 1980. Proceedings. College Station, Texas, Texas Agricultural Experiment Station, 1980.

29/ U.S. Department of Agriculture. Office of Governmental and Public Affairs. Report on U.S. Department of Agriculture Electronic Information Exchange and Dissemination. Washington, 1982.

30/ Arthur D. Little, Inc. Into the Information Age. Chicago, American Library Association, 1978.

31/ U.S. National Commission on Libraries and Information Science. Public Sector/Private Sector Task Force. Public Sector/Private Sector Interaction in Providing Information Services. Washington, U.S. Govt. Print. Off., 1982

32/ Chartrand, Robert L. Information Transfer in a Gifted Age. In Chartrand, Robert L., and James W. Morentz, eds. Information Technology Serving Technology. New York, Pergamon Press, 1979, p. 3-4

Continuing congressional concern about the state of agriculture has taken many forms, and requests for background information have emanated from Members with constituencies across the country. In response to these requirements, the Congressional Research Service has prepared a series of "Issue Briefs" in recent years which deal with salient aspects of agricultural conditions and problems: "Agriculture: Soil Conservation and Farmland Productivity,"33/ "Crisis in the Farm Economy,"34/ "Rural Development: the Federal Role,"35/ and "Agriculture: Significant Legislation of the 97th Congress."36/ The importance of these and related matters is comprehended, although not always in a way that allows the formulation of ameliorative action, in many quarters. The viability of American agriculture may depend in large part, in the future, on the perception of Congress, the Federal executive branch, State and local governmental agencies, and cognizant organizations in the private sector, and their willingness and ability to define objectives and instruments of execution which can render the necessary support to the farming industry.

33/ U.S. Library of Congress. Congressional Research Service. Agriculture: Soil Conservation and Farmland Productivity. Issue Brief No. IB80031, by Rita S. Dallavalle, Feb. 6, 1980 (updated May 21, 1981). Washington, 1981.

34/ U.S. Library of Congress. Congressional Research Service. Crisis in the Farm Economy. Audio Brief No. AB 50056, by Jasper Womach and others, April 1, 1982. Washington, 1982.

35/ U.S. Library of Congress. Congressional Research Service. Rural Development: The Federal Role. Issue Brief No. IB77113, by Sandra S. Osbourn, October 19, 1977 (updated Sept. 23, 1980). Washington, 1980.

36/ U.S. Library of Congress. Congressional Research Service. Agriculture: Significant Legislation of the 97th Congress. Issue Brief No. IB81161, by Elizabeth Withnell, Aug. 20, 1982 (updated Sept. 15, 1982). Washington, 1982.

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